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ABSTRACT

The development of computer-based instruction will be greatly facilitated by the use of an effective and efficient design model. Five components of such a model are: (1) the objective; (2) the content; (3) the questions; (4) the boundaries; and (5) the entry skills. A good objective describes either something observable that learners do, the conditions under which they do it, and the standard of an acceptable performance; or an observable product that learners produce, the conditions under which they produce it, and the standards of an acceptable product. The content may take many forms--definition, description, generalization, principle, rules, and others. Learner processes will vary according to the content type, i.e., a rule-using task requires the learner to state the rule and then to apply it to a previously unencountered example of the class of problems for which the rule is intended. The questions enable the student to interact with the content and they test the student's mastery of the objective. Questions may be stated in interrogative (Which one is green?) or imperative form (Write the sum of three numbers), and three kinds of feedback can be provided: knowledge of results (KR), knowledge of correct results (KCR), or KCR with advancement to next problem or question. The boundaries define the area the objective covers; one part of that area is the domain (stimulus or display), the other is the range (answers to the questions). Entry behaviors are stated for two reasons: to ensure that nothing is omitted and that there are no overlaps between old knowledge and new instruction, and to weed out students who lack prerequisite skills. Examples are provided for each of the five model components. (JB)

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A Model for the Development of Computer Instructional Specifications

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Abstract

1. The objective
    1.1 The learner is the subject of the verb.
    1.2 The verb describes an observable performance or a performance that results in an observable product.
    1.3 The conditions under which the behavior or product will occur are specified.
    1.4 The standard by which the quality of the performance or product will be evaluated is stated.
2. The content
    2.1 Tell the learner what he or she must know to emit the performance or produce the product specified in the objective.
    2.2 Cause the learner to state this information in terms that he or she understands.
3. The questions
    3.1 Ask questions that cause the learner to interact with the content (en route questions).
    3.2 Provide immediate feedback.
    3.3 Ask questions that enable the learner to demonstrate attainment of the objective (criterion questions).
4. The boundaries
    4.1 The domain is the entire class of questions or problems or situations that the objective covers.

or products that meet the requirements of the objective.

4.3 The extrarange boundaries define the incorrect performances or products that have a reasonable probability of occurring.

5. The entry skills

5.1 State the performances or products that are antecedent to attaining the objective.

5.2 Before beginning any instruction, ask questions that enable the teaching system to determine whether or not the learner has the needed entry skills.

It is assumed that the development of computer-based instruction will be greatly facilitated by the use of an effective and efficient design model. The model described below has been tested and found to possess both characteristics. The five components of the model are

1. The Objective
2. The Content
3. The Questions
4. The Boundaries
5. The Entry Skills

1. The Objective

There are many worthwhile treatments of this subject. Probably the best-known, and one of the oldest, is Mager's. Gagne and Briggs advocate a five-component objective that is very powerful, but somewhat difficult for a novice to use. The procedure used here is by Gerlach and Ely; it is limited to objectives dealing with knowledge or intellectual objectives (the cognitive domain). It is not generally used for objectives dealing with such outcomes as attitudes, interests, motor skills, or social behaviors.

Goals, purposes, aims, or objectives should be expressed in propositional terms. This means that a statement must be worded in such a way that the truth or nontruth of that statement can be asserted or verified.

"Tom thinks it will snow tomorrow" is not in propositional form. There is no way that you or I can tell whether it expresses a truth or a nontruth. "Tom says it will snow

tomorrow" is in propositional form. You or I can tell whether the statement is true or not.

"There are 50 stars in a U.S. flag" and "Phoenix is the capital of the U.S." are stated in propositional form. You or I can tell whether they are true or not. "Many people in the USSR are secretly anti-Communist" defies any kind of verification. "John understands the concept of volume" might be true, but we don't know what <u>understand</u> means. John would have to do something or produce something to convince us that he understands. The statement is not in propositional form. "Mrs. Calhoun is convinced that John understands volume" is definitely not in propositional form. You and I have no basis for determining two things: we don't know how to determine that Mrs. Calhoun is convinced; we don't know how she (or anyone else) can determine that John understands.

<u>All objectives must be stated in propositional form</u>. Generally speaking, an objective will meet this standard if it has four characteristics.

<u>A Learner Behavior</u>

These are not good objectives:

gives students examples of Baroque style

pictures life in ancient Athens

presents distinguishing features of a logical syllogism

They do not tell what a learner does or produces. The subjects of the three statements are "the recording", "the film", and "the chapter."

These are good objectives:

compose a sonnet

describe the procedure for locating a dictionary entry

find the area of a trapezoid

The subject of each sentence is "the learner."

A good objective describes something that
learners do or a product that learners produce.

An Observable Behavior or Product

These objectives do not deal with an observable behavior or product:

appreciate the contribution of the Populist movement to the growth of American democracy

know the principles of structured programming

comprehend the difference between light and energy

There is no way to tell exactly what learners will be doing when they appreciate or know or comprehend. One learner who "knows the principles of structured programming" is able to recite a definition; another is able to explain a procedure; still another is able to tell a structured program from all other kinds; a fourth student is able to write structured programs. Neither you nor I can tell which of these constitutes "knows the principles of structured programming."

These objectives do deal with an observable behavior or product:

construct an equilateral triangle

list the parts of spectroscope #D84

score at least 70 on the MAT

These objectives do not allow a multitude of interpretations, as do the previous three. If four different people were to decide whether or not a learner has done what these objectives state, the probability is quite high that the four people would agree. Why? Because the statements describe an observable performance or product.

A good objective describes something <u>observable</u> that learners do or an <u>observable</u> product that learners produce.

A Statement of Conditions

These objectives are incomplete:

run the mile

identify the 23 kinds of trees growing on campus

name the primary colors

There is a difference between running a mile in a track meet on an approved track and running a mile over an obstacle course during a blizzard while carrying a 60-pound load. There is a difference between identifying trees in spring, in fall, and in winter; there is a difference between identifying them from samples of their leaves and bark in a specimen box, and from

color photographs of the trees taken in three different seasons.

These objectives are better:

name the primary colors, given a collection of red, blue, and yellow objects

name the primary colors from memory, without reference to any red, blue, or green objects

translate any three consecutive sentences from Comenius' "Orbis Pictus", given a dictionary and five minutes time

They state the conditions under which the performance or product is to occur. Obviously, the statement of conditions has a significant effect on the meaning of an objective.

A good objective describes something observable that learners do and the conditions under which they do it or an observable product that learners produce and the conditions under which they produce it.

A Standard of Performance

These objectives are incomplete:

spell the words on page 26 correctly when the teacher pronounces them

factor quadratic equations of the type given in Chapter 6 without referring to the book or to any notes

name the causes of the Spanish-American war, given the use of the four textbooks available during the unit

How many words must the student spell correctly? 100%? 80%? 90%? This information would help one decide whether a pupil has attained the objective. How many equations must be factored correctly? five consecutive? eight out of any ten? How many causes must be named? the two most important? four of the five most commonly cited? one from each reference?

These objectives are clearer:

name the capitals of all 50 states, given a blank outline map of the USA showing the state boundaries

spell correctly at least 95% of the words on page 2 when using them in an original composition

write four couplets, each employing a different meter; choose the four meters from this list---

Such expressions as "all 50", "95% of the words", and "four couplets--- four meters" express standards or criteria.

A good objective describes something observable that learners do, the conditions under which they do it, and the standard of an acceptable performance; or an observable product that learners produce, the conditions under which they produce it, and the standard of an acceptable product.

---

2. The Content

All performances or products in the cognitive domain are related to some kind of content. This content may take many different forms. Some of them are definition, description, generalization, principle, and rule; there are many other forms in which content may be expressed.

Several examples should help to clarify the concept "content" as it is used in this model.

Ex. 1: Objective - Divide a proper fraction by another proper fraction, given a problem in the form a/b - c/d =, without reducing the quotient.

What content must a learner process in order to produce an acceptable quotient? In all probability, anyone who can process the rule "invert the divisor and multiply" should be able to attain the objective. If learners can identify the divisor, and if they can perform the operations invert and multiply, they will produce an acceptable quotient. Consequently, the content for this objective is nothing more (but also nothing less!) than the rule.

This rule must be available to the learner. (At this point, the mode of presentation is not under discussion. The rule may be arrived at by induction or inquiry, or it may be given to the learner.)

In this example, the learner should also state the rule, even though the objective does not explicitly require it. For instance, a sequence might be developed in this way.

1. Display the rule.

2. Present a problem.

3. Ask for the answer.

4. If the answer is wrong, return to 1.

5. If the answer is correct, ask the pupil to state the rule.

6. Return to 2.

Ex. 2: Objective - Identify, with 100% accuracy, equilateral, isosceles, and scalene triangles, given representations of each type.

Three rules constitute the content for this objective: An equlateral triangle has three sides of the same length. An isosceles triangle has two sides of the same length and one side of a different length. A scalene triangle has three sides of different lengths.

This content could either be discovered by the learners or given to them. In this case, it seems unlikely that any advantage would result from discovery. Nevertheless, either discovery or presentation must result in the learners' acquiring the three rules.

Ex. 3: Objective - Identify challenges for cause and peremptory challenges, given anecdotal examples of each.

This objective is from a law course. Certain critical attributes differ for each of the two challenges. If the learner can master those attributes, the problem of discriminating between (or identifying) the two challenges should be solved. The necessary rules are --

1. A challenge for cause is made against a prospective juror

who for some specific reason is not qualified to take part in the trial;

2. A peremptory challenge is made against a prospective juror without stating the reason for the challenge.

Given this content, the learner should be able to read an anecdote describing a challenge and tell which of the two challenges was made.

Ex. 4: Objective -- Change an improper fraction to a mixed number.

This is a rule-using task. Although we have not discussed this category, we need not worry about it. Simply remember that every rule-using task requires the learner to do two things: state the rule and apply the rule to a previously unencountered example of the class of problems for which the rule is intended.

There are three elements in the rule:

1. Divide the numerator by the denominator.
2. Write the quotient as a whole number.
3. Write the remainder over the denominator.

(Note that this objective deals only with mixed numbers, e.g., 5/3 = 1 2/3. It does not deal with whole numbers; e.g., 6/3 = 2 is not covered by this objective.)

Any learner who can recite the rule should be able to demonstrate attainment of the objective by applying the rule to legitimate problems. Of course, this attainment usually follows an appropriate amount of practice, but that is what we're concerned with -- how to provide practice that is relevant and that is effective in leading to attainment of the objective.

3. The Questions

The questions enable the student to interact with the content, and they test the student's mastery of the objective.

The questions must be formulated to ensure the student's attainment of the objective. One way to do this is to make sure the students comprehend the content before asking them to exhibit the performance or product specified in the objective. Questions may be stated in interrogative form (Which one is green?) or imperative form (Write the sum of the three numbers).

Ex. 1: The student has been given the rule "Invert the divisor and multiply." This sequence of questions might be used:

What is the divisor?

Invert it.

Change $\div$ to X.

Now write the answer.

To solve $2/3 \div 1/2 = ?$ what must you do first?

After you've inverted the divisor, what do you do?

Now write the answer.

Write the rule for solving.

Now rewrite the problem, making the changes the rule requires.

Write the answer.

This series of questions enables the learners to interact with the rule and to show that they can correctly divide one fraction by another.

Generally speaking, feedback should be provided. Three kinds are available. Knowledge of results (KR) simply tells the

learner yes or no, correct or incorrect, right or wrong, and so on. Knowledge of correct results (KCR) tells the learner the correct answer. A common variation of KCR presents the correct answer if the pupil is wrong, but presents the next problem or question if the answer is correct. KCR assumes that the learner can monitor his own responses correctly. For instance, if the correct answer is 3/2, but the learner has answered 2/3, the learner must know enough arithmetic to recognize two things: that 3/2 and 2/3 are not the same and that 2/3 is wrong. The third kind is knowledge of results with instruction (KRI). If the pupil answers 15/32 to the problem $5/8 \div 3/4$, the computer might respond, "Not quite. You remembered to change - to x, but you forgot to invert the divisor. Try again." KRI is best used in a tutorial manner, as opposed to sending the learners back to the beginning every time they err.

Finally, questions are used to test the ultimate attainment of the objective. In the present example, a test might be administered after the pupil has answered four consecutive practice problems correctly. The test would typically consist of a number of problems, perhaps 10, of the form $a/b \div c/d =$. Usually feedback is not provided. If it is, it generally consists of information about the number correct or incorrect on the postinstruction test. Sometimes the test results are the basis for a prescription for the next step for either the pupil or the teacher or both; this might be repetition, remedial work, new (advanced) work, or some kind of enrichment. Because the form is specified in the objective, the mastery questions in this

example do not permit any variation in form.

Ex. 2: Objective -- Solve linear equations in one variable ($ax + b = c$).

Content -- 1. Subtract b from both sides. 2. Divide both sides by a.

Illustration--

$$3x + 6 = 9$$

1. subtract b from both sides: $-6 = -6$

$$3x = 3$$

2. divide both sides by a: $\div 3 = \div 3$

$$x = 1$$

The question is relatively simple: find x in the equation $ax + b = c$ when a, b, and c are given. We might formulate it in many different ways: Solve for x. Find x. How much is x? x = ?

The more difficult part is formulating en route questions. Although the questions in the preceding paragraph are excellent for a posttest, they are not sufficient for instruction. Here is how we might go about formulating the questions.

$$2x + 4 = 6$$

1-1. Find x.

1-2. What do you do first?
(Subtract from both sides.)

1-3. What do you subtract?
(4)

1-4. Do it.

$$2x + 4 = 6$$
$$\underline{\quad - 4 = -4}$$
$$2x = 2$$

1-5. Now what?

(Divide both sides.)

1-6. What do you divide by?

(2)

1-7. Do it.

$$2x = 2$$
$$\underline{\div 2 \quad = \quad \div 2}$$
$$x = 1$$

Mistakes are bound to occur. Questions must be formulated that will help the learner correct mistakes.

$$3x + 4 = 13$$

2-1. What is the value of x ?

2-2. What do you do first ?

(Divide both sides by the same number.)

2-3. Dividing is the last thing you do. What is the first?

(Subtracting.)

2-4. What do you subtract?

(13)

2-5. The purpose of subtracting is to get rid of the constant on the left side of the equation. What is it?

(4)

2-6. What number do you subtract from both sides if you want to get rid of the constant on the left?

(4)

2-7. Do it.

$$3x + 4 = 13$$
$$\underline{\quad - 4 = -4}$$
$$3x = 9$$

2-8. What next?

(Subtract the same number from both sides.)

2-9. You only subtract once. What do you do after you subtract?

(Divide both sides by the same number.)

2-10. Do it.

$$3x = 9$$
$$\underline{\div 9 \quad = \quad \div 9}$$
$$x/3 = 1$$

2-11. Your x has the number 3 in front of it in 3x = 9.

What's the first question you were asked?

(Solve for x.)

2-12. What number do you divide both sides by?

(The number before the x.)

2-13. Do it.

$$3x = 9$$

$$-3 = -3$$

$$x = 3$$

2-14. State the entire rule.

(First, subtract the left side from both sides of the equation. Then divide both sides of the equation by the number in front of the variable.)

This is the list of questions identified in that process:

1. What is the value of x?
2. What is the first step?
3. What do you subtract from each side?
4. Do the subtraction.
5. What is the second step?
6. What do you divide both sides by?
7. Do the division.
8. Don't divide first; do that last. What do you do first? (Remedial form for #2.)
9. What is the constant on the left side of the equation? (Remedial form for #3.)
10. Don't do the subtraction in the second step; do that first. What do you do in the second step? (Remedial form for #5.
11. What are you supposed to solve for? (Remedial form for #6.)

12. What is the number in front of x? (Remedial form for #6.)

This pool of questions should be sufficient to instruct the learner. As we shall see later, however, nothing stops us from adding questions if we run into unexpected learner difficulties, nor is there any reason to retain questions that are never used. The initial pool of questions is simply our best guess as to what we'll need to ask the learner in order to progress toward attainment of the objective.

Ex. 3: See Objective and Content for "challenges for cause" and "peremptory challenges" in Ex. 3 on pages 11 and 12.

The question for mastery is "Is this a peremptory challenge or a challenge for cause?" Probably only two en route questions would be helpful during instruction:

1. Is there a specific reason that person is not qualified to take part in the trial?
2. Is this person challenged without a reason?

These three questions would make up the entire pool of questions for the objective dealing with the two kinds of challenges.

Here are two examples from science.

*Objective:

Identify cubic, monoclinic, triclinic, tetragonal, hexagonal, and orthorhombic crystals, given representations of each type.

*Content:

Cubic crystals have three axes of equal length meeting at right

angles.

Monoclinic crystals have three unequal axes, two of which are not at right angles. The third makes a right angle to the plane of the other two.

Triclinic crystals have three unequal axes, but none forms a right angle with any other.

Tetragonal crystals have three axes meeting at right angles, two of equal length.

Hexagonal crystals have three equal axes at 120 angles in one plane and one axis of a different length at right angles to these.

Orthorhombic crystals have three axes meeting at right angles, all of different lengths.

*Questions:

1. What kind of crystal is this?
2. How many axes does it have?
3. Which kind of crystal has four axes?
4. Which systems of crystals have three?
5. Are any axes of equal length?
6. How many?
7. Of those with three axes, which system of crystals has three equal axes?
8. Which kind of crystal has two equal axes?
9. Which ones have three unequal axes?
10. Do any of the axes meet at right angles?
11. How many?

12. Which kind of crystal has no axes forming right angles?
13. Of those with axes that form right angles, which system has three meeting at right angles?
14. Which has two axes not at right angles?

*Objective: Calculate the specific gravity of a mineral, given its dry weight and its weight when suspended in water.

*Content: Subtract weight in water from dry weight. Divide dry weight by the loss.

*Questions:

1. A mineral specimen weighs (no. of grams) when suspended in water. Its dry weight is (no. of grams). What is the specific gravity of the mineral?
2. What is the first step?
3. Do the subtractions
4. What do you do next?
5. Divide.
6. Subtract the weight in water from the dry weight. What is the number you subtract. (Remedial for 2.)
7. You only subtract once. What comes after subtraction? (Remedial for 4.)
8. Divide dry weight by the loss of weight in water. What number do you divide into?
9. What number do you divide by? (Remedial for 4.)

4. The Boundaries

The boundaries define the area the objective covers. One part of that area is called the domain. Consider the task of teaching children to add; each of the following examples is a member of a different domain.

1. 2 + 3 = ? -- two single-digit whole numbers
2. 2 + 7 + 4 + 1 + 8 = ? -- three or more single-digit whole numbers
3. 23 + 46 = ? -- two two-digit whole numbers, no carrying
4. 126 + 42 + 8793 + 7 = ? -- three or more one- to four-digit whole numbers
5. 2/5 + 1/5 = ? -- two proper fractions, one-digit denominators, sum not requiring reducing
6. 1.64 + 17.329 = ? -- two mixed decimals, no boundaries on either the whole or the decimal portion

There are many other possible domains for the task "adding."

The reason for writing the boundaries section is to enable the developer to create a pool of items from which to construct the questions. Although one might argue that this information should be given in the <u>conditions</u> portion of a well-stated objective, this is seldom the case. For example, a widely-

accepted instructional design model uses this example to illustrate a well-written objective:

> To add whole numbers, given problems in either vertical or horizontal form, with an accuracy of at least six consecutive correct answers in any set of 10 problems.

This objective would cover any or all of examples 1. to 4., above.

To design good instruction, one must establish the specific domain of whole numbers. This is done by writing the domain portion of the boundaries section.

The examples given above deal with the content domain. In many instructional design tasks, a form domain must be specified, too. Will the addition problems look like this?

2 + 2 = ?

or

two + two = ?

or

Add 2 and 2

or

What is the sum of 2 and 2?

The instructional designer must specify in the domain section the form or forms to be used when the questions are displayed.

A further illustration of the point is the example of the three types of triangles used earlier. The domain section of the boundaries must specify the sizes, positions, colors, and other characteristics that must be present when the triangles are displayed in the questions.

In many kinds of instruction, learners must classify examples as members or nonmembers of a given class. For instance, the pupil is learning to identify peninsulas. The presentation should include a variety of peninsulas (called exemplars) as well as a variety of nonpeninsulas (called nonexemplars) that one might reasonably confuse with peninsulas. Nonexemplars might include islands, isthmuses, bays, or gulfs.

In the addition illustration, nonexemplars such as

$$32 + @ \quad = ?$$

or

$$\text{number} + \text{fraction} = ?$$

hardly seem necessary. In the peninsula example, the nonexemplars are indispensable. Generally speaking, the domain must specify both exemplars and nonexemplars if the objective deals with any kind of discrimination learning, such as concept formation.

The boundaries discussed thus far pertain to the stimulus, or display, characteristics of the instruction. Everything specified in the domain section constitutes a pool from which elements of the questions are drawn. The second section of the boundaries deals with the <u>answers</u> to the questions. This section is called the range. The entire set of learner responses that satisfy the requirements of the performance or product specified in the objective constitutes the range. It is helpful to think of the two sections of the boundaries thus: the stimulus domain

and the response range.

Consider the adding objective again:

Domain -- Two proper fractions, common denominators less than 10.

These problems are some of the possibilities

1. 2/5 + 1/5 = 3/5
2. 2/5 + 3/5 = 5/5
3. 2/5 + 3/5 = 1
4. 1/8 + 3/8 = 4/8
5. 1/8 + 3/8 = 2/4
6. 1/8 + 3/8 = 1/2
7. 2/3 + 2/3 = 4/3
8. 2/3 + 2/3 = 1 1/3

Each of the eight meets the requirements specified in the domain; however, it would be very helpful to know whether the developer should include problems whose sum is greater than 1, or whose sum requires reducing, or whose sums equals 1, and so on. This kind of precision is achieved by defining the range:

Sums must be less than 1 and not require reducing.

That range statement would restrict the examples used in the questions to those that belong to the class 2/5 + 1/5; none of the other seven examples meets the requirement. Another example of the range is this:

Sums must be 1 or more, converted from an improper fraction to a mixed or whole number.

Examples 3. and 8. belong to this range.

What about 2. and 7.? Examples 2. and 3. are identical, but

the answers are different; the same is true of 7. and 8. The answers 5/5 and 4/3 are not acceptable because they lie outside the specified range. They are, however, "reasonable" incorrect answers (wrong answers that have a reasonable probability of occurring). Such answers should be specified in the extrarange (i.e., "outside the range") section of the boundaries. In this case, the extrarange boundaries would be these:

Sums correct in the form of an improper fraction, but not converted to a mixed or whole number.

The extrarange boundaries have a number of uses. The most obvious is remediation. If a pupil answers 4/3 for 2/3 + 2/3 it is quite reasonable to infer that partial learning has occurred; the pupil correctly writes the sum of the numerators over the common denominator. Consequently, instruction should be addressed to converting an improper fraction to a mixed or whole number. When that subskill is mastered, instruction in addition of fractions should be resumed.

In summary, the instructional specification should look something like this:

*Objective:

To add two proper fractions with a common denominator less than 10, with an accuracy of at least seven consecutive correct responses in any set of 10 problems.

*Content:

1) Write the denominator of your answer first. It is

exactly the same as the denominator of the two fractions you're adding.

2) Write the sum of the two numerators over the denominator of your answer. If the numerator is less than the denominator the result is your sum.

3) If the numerator is not less than the denominator, divide the numerator by the denominator. If there is no remainder, the quotient is your sum. If there is a remainder, write it in fraction form after the quotient. The result is your sum.

*Questions:

1. a/x + b/x = ?

2.
$$\begin{array}{r} a/x \\ +b/x \\ \hline ? \end{array}$$

*Boundaries:

Domain:

Exemplars:

Two proper fractions, common denominator less than 10 (3/5 + 4/5)

Problems displayed in numeric form, either vertically or horizontally, with + and = signs

Nonexemplars:

Problems whose sum requires reducing (1/4 + 1/4).

Problems displayed in semantic form (how much is 2 and 2 ?; two + two = ?)

Range:

Sums must be less than 1, or 1, or a mixed number (2/3, 1, 1 3/5).

Extrarange:

Improper fractions that are correct sums (3/3, 7/6)

Ex. 1: We'll use the objective, content, and questions for peremptory challenges and challenges for cause (Ex. 3, p 20).

Domain:

Exemplars:

a) Challenge for cause. Anecdotes that portray a prospective juror as related to a principal, associated with a principal in a positive or negative manner, overly familiar with the case, prejudiced for or against offenses the same as or similar to that of which defendant is accused, prejudiced for or against type of sentence to which defendant is liable.

b) Peremptory challenge. Any characteristic of prospective juror, such as height, weight, color of hair, place of residence, schooling, brand of

cigarettes smoked, number of children, handicap in golf, providing that none of these characteristics is substantively related to the nature of the case or the principals.

Nonexemplars:

a) Challenge for cause. All the instances under peremptory challenge exemplars.

b) Peremptory challenge. All the instances under challenge for cause exemplar

Range:

Response must be either challenge for cause or peremptory challenge.

Extrarange:

Not relevant. (The words challenge for cause and peremptory challenge are in the questions. Consequently, no other responses are probable.)

Ex. 2: Objective: Identify declarative and interrogative sentences. (Note: the words declarative and interrogative are not used in the test or instruction.)

*Content:

(Declarative sentence) This sentence tells something. It is a telling sentence. This sentence is not an asking sentence.

(Interrogative sentence) This sentence asks something. It is a question. This sentence is not a telling sentence.

*Questions:

Is this a telling sentence?

Does this sentence tell something?

Is this a question?

Does this sentence ask something?

*Boundaries:

Domain:

Exemplars:

a) declarative sentences: Punctuated and unpunctuated simple, compound, and complex sentences.

b) interrogative sentences: Punctuated and unpunctuated simple, compound, and complex sentences.

Nonexemplars:

a) declarative sentences: All exemplars of interrogative sentences; words; phrases; addresses; dates (July 4, 1984).

b) interrogative sentences: All exemplars of declarative sentences; words; phrases; addresses; dates.

Range:

Telling sentence

Question

Extrarange:

Exclamatory sentences

Imperative sentence

Indirect questions

Ex. 3: Objective: Capitalize the first word of a sentence.

*Content:

The first word in a sentence is capitalized. Do not begin a new line with a capital letter unless the first word of the new line begins a sentence. Use a capital letter to start the word after a period, question mark, or exclamation point. Use a small letter to start the word after a comma or semicolon. Use a small letter to start the word after a period following an abbreviation in the middle of a sentence.

*Questions:

Should this word begin with a capital or a small letter?

Which word in a sentence is always capitalized?

The word after a (terminal punctuation) begins with a _____ letter.

Mark the words that should be capitalized.

Is (abbreviation in midsentence) an abbreviation?

Should the word after (abbreviation in mid-sentence) begin with a small or a capital letter?

Should the word after (word) be capitalized?

Should (word beginning new line, not a new sentence) begin with a capital or a small letter?

Is (word) the first word of a sentence?

*Boundaries:

Domain:

Exemplars

.

?

!

Abbreviation and new sentence

Period

Exclamation point

Question mark

First word of a sentence

First word of a sentence in midline

Nonexemplars

Abbreviation in midsentence

,

;

Comma

Semicolon

New line not a new sentence

Words in midsentence

Range:

Capital letter

Extrarange:

Small letters.

Here are two examples from foreign language.

*Objective: Given a sentence in French, replace the definite article with the correct indefinite article.

*Content:

Un is the masculine indefinite article.

Une is the feminine indefinite article.

Un replaces le.

Une replaces la.

*Questions:

1. Replace the definite article with an indefinite article.
2. What is the definite article?
3. Is it masculine or feminine?
4. Which indefinite article replaces a (gender) definite article?
5. The definite articles in French are la and le. What is the definite article in this sentence? (Remedial for 1.)
6. Le is masculine; la is feminine. Is the article in this sentence masculine or feminine? (Remedial for 2.)
7. Un replaces le, the masculine article. Une replaces la,

the feminine article. Which belongs in this sentence? (Remedial for 3.).

*Boundaries:

Domain:

Examples

French declarative and interragative sentences that contain singular definite articles.

Nonexamples

Sentences that contain plural definite articles.

Sentences containing prepositions that require contraction of the preposition and the definite article.

Range:

Masculine and feminine indefinite articles

Extrarange:

Masculine and feminine definite articles

Plural definite and indefinite articles

*Objective: Given a personal pronoun and an infinitive, type the correct verb form in present tense.

*Content:

The verb stem is the infinitive minus the last two letters.

The verb form consists of the verb stem and the ending.

Endings for the personal pronouns are as follows:

First person singular: je(I) e

Second person singular: tu(you) es

Third person singular: il, elle (he, she) e

First person plural: nous(we) ons

Second person plural: vous(you) ez

Third person plural: ils, elles (they) ent

*Questions:

1. Which form of (infinitive) is used with (personal pronoun) in present tense?
2. What must you do first?
3. How do you form the verb stem?
4. What is the stem of (infinitive)?
5. What do you do next?
6. What is the correct ending for (personal pronoun)?
7. Add the ending.
8. You cannot add endings directly to the infinitive . What must you do to it first? (Remedial for 2.)
9. Drop the last two letters of (infinitive). (Remedial for 3 or 4.)

*Boundaries:

Domain:

Examples

Personal pronouns in the nominative case

Infinitives of regular French verbs of first conjugation

Nonexamples

Pronouns in the objective or possessive cases

Infinitives of irregular verbs

Infinitives of verbs of other conjugations

Range:

First, second, and third person signular and plural forms of first conjugation verbs

Extrarange:

Verb forms of other conjugations

Verb forms of other tenses

5. Entry behavior

Every objective that is used in a school or training situation assumes that the learner or trainee can exhibit some kind of specified behavior or product before instruction. Learners who cannot discriminate between water and land on a map should not begin instruction on identifying peninsulas. Pupils who cannot determine whether one line is as long as another should not begin instruction on naming three types of triangles.

Whatever it is that learners must know or be able to do before learning a new objective is called entry behavior. Entry behavior frequently consists of a preceding objective or set of objectives.

In the fraction adding illustration, the entry behaviors are

1.) adding two single-digit whole numbers

2.) discriminating between numerator and denominator

3.) identifying a common denominator

The purpose of stating entry behaviors is twofold. They guide the developer, helping to ensure that nothing is omitted and that there are no overlaps between old knowledge and new instruction. They provide specifications for constructing an entry test; such a test is used to ensure that no pupil wastes time on instruction that is too difficult for him because he lacks prerequisite skills.

* * * * *

Application of this model to design and development tasks has resulted in precise specifications. These specifications may take the form of an outline, a story board, a set of "screen sheets", or any other kind of form that is useful. The specifications provide the precise instructions that the computer programmer, regardless of whether he or she is using a high level language or an authoring system, can use to produce the desired instruction or training.